

We Claim:

1. A blood processing system comprising
a donor flow channel to convey fluid to and from
a donor,

5 a blood processing flow channel including a blood
separation chamber to separate a blood component from donor
blood,

10 a blood component collection flow channel
including a blood component collection container,

15 a pump station communicating with the donor flow
channel, the blood processing flow channel, and the blood
component collection flow channel, and

20 a controller to operate the pump station in
multiple modes, including a processing mode, during which the
pump station is operated to convey blood in the donor flow
channel into the blood processing flow channel for separation
of the blood component in the blood separation chamber, and
a collection mode, during which the pump station is operated
to convey at least some of the blood component in the blood
processing flow channel into the blood component collection
flow channel for collection in the blood component collection
container.

25 2. A system according to claim 1
wherein the blood component collection flow
channel includes a filter to remove undesired materials from
the blood component before entering the blood component
collection container.

30 3. A system according to claim 2
wherein the filter removes leukocytes.

35 4. A system according to claim 1
wherein the controller operates the pump station
in a blood component return mode, during which the pump
station is operated to convey at least some of the blood
component in the blood processing flow channel into the donor
flow channel for return to the donor.

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for mixing with the blood component returned to the donor.

wherein the processing fluid includes saline.

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component additive.

pressure to the pump, and /

actuator. /

collection flow channel/ communicate within a cassette,

11. A system according to claim 10

5 further including an actuator to receive the cassette and operate the pump station, and wherein the controller is coupled to the actuator.

12. A system according to claim 1 wherein the blood processing flow channel includes a blood component holding container to hold the blood component, and

5 wherein, in the collection mode, the pump station is operated to convey at least some of the blood component in the blood component holding container into the blood component collection flow channel.

13. A system according to claim 12 wherein the controller operates the pump station in a blood component return mode, during which the pump station is operated to convey at least some of the blood component in the blood component holding container into the donor flow channel for return to the donor.

14. A system according to claim 1 wherein the blood processing flow channel includes a donor blood holding container to hold donor blood prior to separation in the blood separation chamber, and
5 wherein, in the processing mode, the pump station is operated to convey blood in the donor flow channel into the donor blood holding container.

15. A system according to claim 14 further including a second pump station, independent of the first defined pump station, communicating with the donor blood holding container and the blood separation chamber and operating to convey donor blood from
5 the donor blood holding container in the blood separation chamber for separation in the blood component.

16. A system according to claim 1 wherein the pump station comprises first and second fluid pressure actuated pump stations, and

5 a fluid pressure actuator operating to selectively apply fluid pressure pump strokes in tandem to the first and second pump stations to convey fluid from a source to a destination,

10 wherein, during at least one of the multiple modes, the controller switches between a first flow state, in which the pump strokes draw a fluid volume into the first pump station from the source and expel a fluid volume from the second pump station to the destination, and a second flow state, in which the pump strokes draw a fluid volume into the second pump station from the source and expel a fluid volume from the first pump station to the destination, the control function operating to synchronize the pump strokes so that fluid flow from the source is essentially continuous while fluid flow to the destination is pulsatile.

15 17. A system according to claim 1 wherein the blood component comprises red blood cells.

18. A system according to claim 1 wherein the blood component comprises plasma.

19. A blood processing system comprising a donor flow channel to convey fluid to and from a donor,

5 a blood processing flow channel including a blood separation chamber to separate red blood cells from donor whole blood,

10 a blood component collection flow channel including a red blood cell collection container and an in-line filter to remove leukocytes from the red blood cells before entering the red blood cell collection container,

a pump station communicating with the donor flow channel, the blood processing flow channel, and the blood component collection flow channel, and

15 a controller to operate the pump station in multiple modes, including a processing mode, during which the

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20 pump station is operated to convey whole blood in the donor flow channel into the blood processing flow channel for separation of the red blood cells in the blood separation chamber, and a collection mode, during which the pump station is operated to convey at least some of the red blood cells in the blood processing flow channel into the blood component collection flow channel for on-line removal of leukocytes and collection in the red blood cell collection container.

20. A system according to claim 19

5 wherein the controller operates the pump station in a blood component return mode, during which the pump station is operated to convey at least some of the red blood cells in the blood processing flow channel into the donor flow channel for return to the donor.

21. A system according to claim 19

5 further including a utility flow channel including a processing fluid container,

5 wherein the pump station communicates with the utility flow channel, and

wherein the controller operates the pump station during the blood component return mode to convey processing fluid in the utility flow channel into the donor flow channel for mixing with the red blood cells returned to the donor.

22. A system according to claim 21

wherein the processing fluid includes saline.

23. A system according to claim 19

further including a utility flow channel including a processing fluid container,

5 wherein the pump station communicates with the utility flow channel, and

10 wherein the controller operates the pump station in a processing fluid transfer mode, during which the pump station is operated to convey processing fluid in the utility flow channel into the blood processing flow channel for mixing with the red blood cells.

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24. A system according to claim 23
wherein the processing fluid includes a red blood
cell additive.

25. A system according to claim 19
wherein the pump station includes a fluid
pressure actuated pump and an actuator to apply fluid
pressure to the pump, and

5 wherein the controller is coupled to the
actuator.

26. A system according to claim 19
wherein the pump station, the donor flow channel,
the blood processing flow channel, and the blood component
collection flow channel communicate within a cassette.

27. A system according to claim 26
further including an actuator to receive the
cassette and operate the pump station, and

5 wherein the controller is coupled to the
actuator.

28. A system according to claim 19
wherein the pump station comprises first and
second fluid pressure actuated pump stations, and
a fluid pressure actuator operating to
5 selectively apply fluid pressure pump strokes in tandem to
the first and second pump stations to convey fluid from a
source to a destination,

10 wherein, during at least one of the multiple
modes, the controller switches between a first flow state,
in which the pump strokes draw a fluid volume into the first
pump station from the source and expel a fluid volume from
the second pump station to the destination, and a second flow
state, in which the pump strokes draw a fluid volume into the
second pump station from the source and expel a fluid volume
15 from the first pump station to the destination, the control
function operating to synchronize the pump strokes so that
fluid flow from the source is essentially continuous while

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fluid flow to the destination is pulsatile.

29. A blood processing method comprising the steps of

5 coupling a multi-function pump station to a donor flow channel to convey fluid to and from a donor, a blood processing flow channel including a blood separation chamber to separate a blood component from donor blood, and a blood component collection flow channel including a blood component collection container, and

10 operating the pump station in multiple modes, including a processing mode, during which the pump station is operated to convey blood in the donor flow channel into the blood processing flow channel for separation of the blood component in the blood separation chamber, and a collection mode, during which the pump station is operated to convey at
15 least some of the blood component in the blood processing flow channel into the blood component collection flow channel for collection in the blood component collection container.

30. A method according to claim 29

5 wherein, in operating the pump station in the collection mode, the blood component is passed through an in-line filter in the blood component collection flow channel to remove undesired materials from the blood component before entering the blood component collection container.

31. A method according to claim 30
wherein the filter removes leukocytes.

32. A method according to claim 29

5 further including operating the pump station in a blood component return mode, during which the pump station is operated to convey at least some of the blood component in the blood processing flow channel into the donor flow channel for return to the donor.

33. A method according to claim 29

further including coupling the pump station to a

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utility flow channel including a processing fluid container,
operating the pump station during the blood
component return mode to convey processing fluid in the
utility flow channel into the donor flow channel for mixing
with the blood component returned to the donor.

34. A method according to claim 33
wherein the processing fluid includes saline.

35. A method according to claim 29

further including coupling the pump station to a
utility flow channel including a processing fluid container,
and

operating the pump station in a processing fluid
transfer mode, during which the pump station is operated to
convey processing fluid in the utility flow channel into the
blood processing flow channel for mixing with the blood
component.

36. A method according to claim 35
wherein the processing fluid includes a blood
component additive.

37. A method according to claim 29
wherein the blood component comprises red blood
cells.

38. A method according to claim 29
wherein the blood component comprises plasma.

39. A method according to claim 29
wherein the pump station comprises first and
second fluid pressure actuated pump stations, and
a fluid pressure actuator operating to
selectively apply fluid pressure pump strokes in tandem to
the first and second pump stations to convey fluid from a
source to a destination,

wherein, during at least one of the multiple
modes, operation of the pump station is switched between a
first flow state, in which the pump strokes draw a fluid
volume into the first pump station from the source and expel

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a fluid volume from the second pump station to the destination, and a second flow state, in which the pump strokes draw a fluid volume into the second pump station from the source and expel a fluid volume from the first pump station to the destination, the control function operating to synchronize the pump strokes so that fluid flow from the source is essentially continuous while fluid flow to the destination is pulsatile.

40. A red blood cell processing method comprising the steps of

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coupling a multi-function pump station to a donor flow channel to convey fluid to and from a donor, a blood processing flow channel including a blood separation chamber to separate red blood cells from donor whole blood, and a blood component collection flow channel including a red blood cell collection container and an in-line filter to remove leukocytes from the red blood cells before entering the red blood cell collection container,

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operating the pump station in multiple modes, including a processing mode, during which the pump station is operated to convey whole blood in the donor flow channel into the blood processing flow channel for separation of the red blood cells in the blood separation chamber, and a collection mode, during which the pump station is operated to convey at least some of the red blood cells in the blood processing flow channel into the blood component collection flow channel for on-line removal of leukocytes and collection in the red blood cell collection container.

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41. A method according to claim 40
further including operating the pump station in a blood component return mode, during which the pump station is operated to convey at least some of the red blood cells in the blood processing flow channel into the donor flow channel for return to the donor.

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42. A method according to claim 40

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43. A method according to claim 42

44. A method according to claim 40

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45. A method according to claim 44

46. A method according to claim 40

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